Feeding habits of common pandora *Pagellus erythrinus* (Sparidae) from eastern central Adriatic Sea

by

Mate ŠANTIĆ*, Antonela PALADIN & Biljana RAĐA (1)

ABSTRACT. - The diet of common pandora, *Pagellus erythrinus* (Linnaeus, 1758), from the central Adriatic Sea, was investigated with respect to season and fish size. Stomach contents of 798 specimens, total length (TL) of 9.2-26.1 cm, collected from commercial bottom trawls from January to December 2009 were analysed. The prey items identified in the stomachs belong to seven major groups: Decapoda, Bivalvia, Polychaeta, Euphausiacea, Teleostei, Mysidacea and Cephalopoda. Decapods were the most important ingested prey (%IRI = 79.3), especially in medium sized fish (TL = 13-21 cm). Polychaetes constituted the main prey item of smallest fish (< 13 cm TL) while decapods together with teleosts dominated the stomach contents of larger specimens (> 21 cm TL). The shrimps *Alpheus dentipes* (%IRI = 3.2) and *Processa canaliculata* (%IRI = 2.0), and the polychaet *Aphrodite aculata* (%IRI = 0.9) were the most frequent prey. Diet of common pandora indicated high similarity between sampling locations. Diet composition showed little seasonal variation, with decapods being the most important prey during summer. The percentage of empty stomachs showed seasonal variation with maximal occurrence in winter (48.9%) and minimal in summer (19.0%). The lowest feeding frequency could be related to low sea temperatures during the winter and with spawning period throughout spring. The stomach contents of common pandora indicate that this species could be considered as generalist predator.

RÉSUMÉ. - Régime alimentaire du pageot commun *Pagellus erythrinus* (Sparidae) de la mer Adriatique centre-orientale.

Le régime alimentaire du pageot commun, *Pagellus erythrinus*, de la mer Adriatique a été étudié en fonction de la taille des poissons et de la saison. Les contenus stomacaux de 798 spécimens, de 9,2 à 26,1 cm de longueur totale (TL), capturés par chalutage de janvier à décembre 2009, ont été analysés. Le pourcentage de vacuité a changé de manière significative en fonction de la saison, avec un nombre maximal d'estomacs vides enregistré pendant l'hiver (48,9%) et un nombre minimal enregistré pendant l'été (19,0%). Le contenu stomacal de *Pagellus erythrinus* s'est révélé composé de sept groupes principaux de proies: crustacés décapodes, bivalves, annélides polychètes, crustacés euphausiacés, téléostéens, crustacés mysidacés et céphalopodes. Les annélides polychètes constituent les proies principales dans les classes de tailles inférieures à 13 cm. Les crustacés décapodes constituent les proies principales dans la classe de taille 13-21 cm. Les crustacés décapodes et les téléostéens constituent les proies principales dans les classes de tailles supérieures à 21 cm. Au niveau spécifique, les crevettes *Alpheus dentipes* (%IRI = 3,2) et *Processa canaliculata* (%IRI = 2,0) puis le polychète *Aphrodite aculata* (%IRI = 0,9), ont été les proies les plus fréquentes. La composition du régime alimentaire a montré peu de variations saisonnières: les crustacés décapodes ont été dominants quelle que soit la saison, et particulièrement l'été. La plus faible intensité d'alimentation a été enregistrée pendant la période de reproduction (printemps) et de minimum thermique (hiver). Les résultats indiquent que le pageot commun s'alimente à partir d'un large éventail de proies, et qu'il peut être considéré comme un prédateur généraliste.

Key words. - Sparidae - *Pagellus erythrinus* - MED - Adriatic Sea - Diet.

Studying feeding habits of marine fish, such as predator-prey relationships is useful in order to assess the role of marine fish in the ecosystem (Bachok *et al*., 2004). However, data on diet composition are useful for developing trophic models as a tool of understanding the complexity of coastal ecosystems (Lopez-Peralta and Arcila, 2002; Stergiou and Karpouzi, 2002). Diet analysis is also necessary for exploring the trophic overlap within and between species and determining the intensity of the inter- and intraspecific interactions in marine fish communities (Morte *et al*., 2001).

The common pandora, *Pagellus erythrinus* (Linnaeus, 1758) is widely distributed throughout the Mediterranean, common from south Brittany to Cape Verde, but rare in the Black Sea (Bauchot and Hureau, 1986). In the Adriatic Sea it is found over sandy-muddy bottoms, mostly up to 100 m (Jardas, 1996). The common pandora is predominantly a diurnal feeder (Benli *et al*., 2001). In the Tyrrhenian Sea and Greek waters, Ardizzone and Messina (1983) and Caragitsou and Papaconstantinou (1985, 1988) describe common pandora as a carnivorous fish. In the western Mediterranean and Egyptian Mediterranean waters diet is mainly based on zoobenthic invertebrates (Larrañeta, 1964; Rosecchi, 1983; Rizzkala *et al*., 1999). In the Adriatic Sea, although different aspects of its biology have been studied (Jukić and Arneri, 1984; Jukić and Piccinetti, 1987) studies of diet are scarce. Only two studies provide some information on diet of the

(1) Department of Biology, Faculty of Natural Science and Mathematics, University of Split, Teslina 12, 21000 Split, Croatia. [antonela.paladin@pmfst.hr] [radja@pmfst.hr]

* Corresponding author [msantic@pmfst.hr]

common pandora in a very limited area (Kaštela Bay) (Jukić and Županović, 1965; Jukić, 1972).

The aim of the present study was to examine the feeding habits of common pandora in the eastern central Adriatic Sea. The effects of predator size and season on stomach contents were included to provide a more comprehensive examination of the trophic ecology of this species.

MATERIAL AND METHODS

Samples of common pandora were collected from five different locations in the eastern central Adriatic Sea at depths between 60 and 90 m (Fig. 1). Fish were randomly sampled from commercial bottom-trawls (codend mesh size: 22 mm) operating during daylight.

A total of 798 specimens were collected seasonally from January to December 2009: 216 specimens during winter, 231 during spring, 181 during summer and 170 during autumn. Total length (TL) of fish was measured to the nearest mm and mass to the nearest 0.1 g. Immediately after capture, fish were dissected and the stomach was removed and preserved in 4% formalin solution. Evidence of regurgitation was not observed in any fish. Prey was identified to the lowest taxonomic level possible. Abundance and blotted mass (± 0.001 g) per food item were recorded.

In the present study, the following indices were used (Berg, 1979; Hyslop, 1980; Tirasin and Jørgensen, 1999):

Vacuity index (VI) = [Number of empty stomachs / Total number of stomachs] x 100;

Percentage frequency of occurrence (%F) = [Number of stomachs in which a food item was found / Total number of non-empty stomachs] x 100;

Percentage numerical abundance (%Cn) = [Number of each prey item in all non-empty stomachs / Total number of food items in all stomachs] x 100;

Percentage gravimetric composition (%Cw) = [Wet weight of each prey item / Total weight of stomach contents] x 100.

The main food items were identified using the Index of Relative Importance (IRI) of Pinkas *et al*. (1971), as modified by Hacunda (1981):

IRI = %F x (%Cn + %Cw)

The index was expressed as: %IRI = (IRI/ ∑ IRI) x 100

Prey species were sorted in decreasing order according to IRI and then cumulative %IRI was calculated.

The variation in vacuity index (VI) was tested by a chi-square test of a contingency table with the number of empty stomachs (Sokal and Rohlf, 1981). After checking the normality of each variable and the homogeneity of variances (Zar, 1984), the effects of length class and season on the mean number (Nm/ST) of prey items and mean weight per stomach (Wm/ST) were tested by analysis of variance (ANOVA). Tukey's test was employed to locate the source

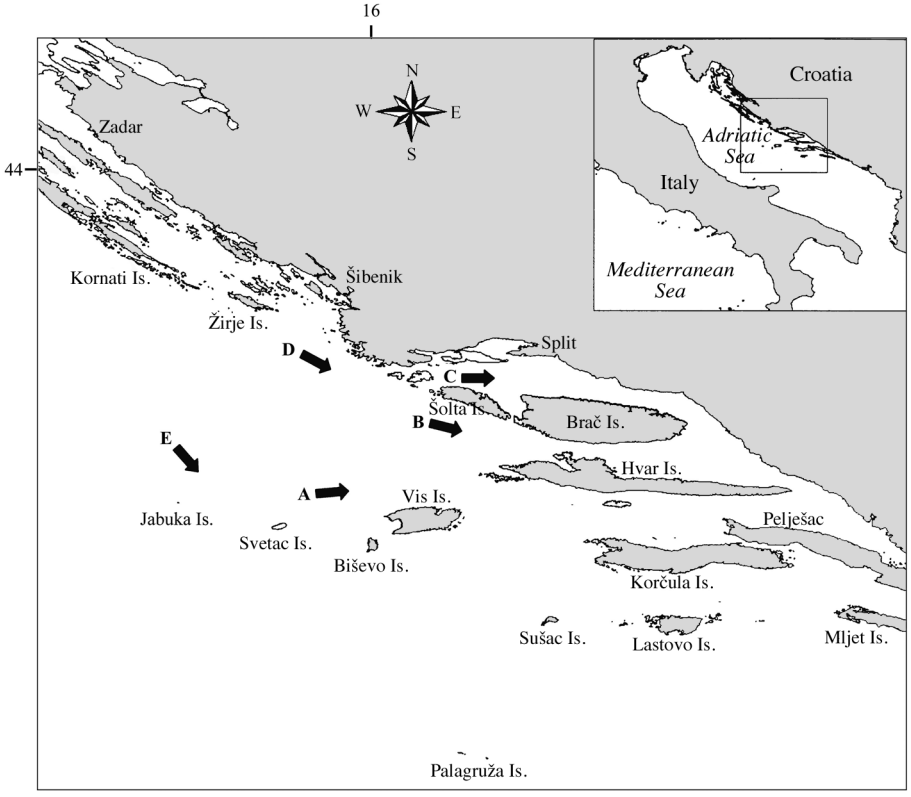

Figure 1. - Study area and all sampling locations in the eastern central Adriatic Sea. **A**: near islands Vis and Svetac; **B**: Maslenica area, south of Solta Island; **C**: Split Channel, **D**: Blitvenica fishing area; **E**: Island of Jabuka. Arrows represent the fishing direction.

of significant differences (Zar, 1984).

Proportional food overlap between predator size classes and seasons was calculated using Schoener's dietary overlap index: $C_{xy} = 1 - 0.5 \sum |P_{xi} - P_{yi}|$, where P_{xi} and P_{yi} are the proportion of prey i (based on %IRI) found in the diet of groups x and y. This index ranges from 0 (no prey overlap) to 1 (all food items in equal proportions). Schoener's index values above 0.6 are usually considered to indicate significant overlap (Wallace, 1981).

The spatial differences in diet due to sample locations were examined using two statistical techniques, cluster analysis and non-metric multidimensional scaling (MDS). These methods were carried out using the Bray-Curtis similarity index on data of prey abundance between sampling locations. We used PRIMER 5.1 software.

RESULTS

Feeding intensity

Of the 798 stomachs of common pandora examined, 207 were empty (25.9%). The proportion of empty stomachs varied significantly over the year ($\chi^2 = 60.1$, $p < 0.05$) with a maximal occurrence during winter (48.9%) and minimal occurrence (19.0%) during summer (Tab. I). Percentage of empty stomachs among size classes ranged from 19% (size class > 21 cm) to 28.9% (size class 17-21 cm) though did not differ significantly ($\chi^2 = 6.3$, $p > 0.05$) between size classes (Tab. II).

Diet composition

Prey items identified in stomachs belonged to seven major groups: Decapoda, Bivalvia, Polychaeta, Euphausiacea, Teleostei, Mysidacea and Cephalopoda (Tab. III). Decapod crustaceans were the most important ingested prey group, constituting 79.3% of the total IRI, followed by

Table I. - Dietary groups for each season of *Pagellus erythrinus* with regard to the percentage frequency occurrence (%F), percentage of numerical composition (%Cn), percentage of gravimetric index (%Cw) and index of relative importance (IRI). n = number of specimens examined in each season; VI = Vacuity index.

Prey groups	Winter				Spring				Summer				Autumn			
	% F	% Cn	% Cw	IRI	% F	%Cn	%Cw	IRI	% F	%Cn	% Cw	IRI	% F	%Cn	% Cw	IRI
Bivalvia	18.5	18.0	20.4	710.4	12.0	15.6	21.2	441.6	16.2	19.2	16.4	576.7	19.2	17.8	17.3	673.9
Cephalopoda	8.1	5.4	6.5	96.4	2.4	1.5	3.8	12.7	–	–	–	–	–	–	–	–
Polychaeta	12.1	17.1	14.5	382.3	9.6	14.0	12.1	250.5	7.3	7.1	6.1	96.3	6.7	7.7	11.5	128.6
Decapoda	40.5	36.0	32.8	2786.4	36.1	31.2	38.0	2498.1	61.0	49.4	55.7	6411.1	32.3	54.1	54.9	3520.7
Euphausiacea	–	–	–	–	4.8	11.7	3.8	74.4	8.1	16.4	13.4	241.3	7.6	17.8	10.4	214.3
Mysidacea	–	–	–	–	7.2	11.7	5.7	125.2	1.6	2.7	1.5	6.7	–	–	–	–
Teleostei	18.9	19.8	21.8	786.2	7.2	6.2	7.6	99.3	3.2	2.7	5.8	27.2	3.8	2.3	5.7	30.4
n		216				231				181				170		
VI		48.9				47.7				19.0				24.0		

Table II. - Dietary groups for each size range of *Pagellus erythrinus*. Abbreviations as in table I.

Prey groups	< 13 cm				13-17 cm				17-21 cm				> 21 cm			
	% F	% Cn	% Cw	IRI	% F	%Cn	%Cw	IRI	% F	%Cn	% Cw	IRI	% F	%Cn	% Cw	IRI
Bivalvia	3.8	4.2	8.8	49.4	12.1	25.9	24.7	612.2	15.8	28.1	29.4	908.5	6.3	11.7	6.4	114.0
Cephalopoda	–	–	–	–	–	–	–	–	–	–	–	–	7.2	9.4	12.0	154.0
Polychaeta	15.2	43.8	30.3	1126.3	5.0	11.4	11.8	116.0	2.0	3.7	7.2	21.8	–	–	–	–
Decapoda	15.1	18.7	25.9	677.9	44.9	55.4	57.6	5073.7	58.2	58.7	53.6	6535.8	22.5	38.8	38.6	1741.5
Euphausiacea	13.7	20.3	23.3	597.3	1.0	4.8	2.7	7.5	–	–	–	–	–	–	–	–
Mysidacea	6.1	10.6	7.4	109.8	–	–	–	–	–	–	–	–	–	–	–	–
Teleostei	–	–	–	–	–	–	–	–	3.3	3.1	6.7	32.3	18.7	40.0	42.9	1550.2
n		162				278				221				137		
VI		24.6				27.6				28.9				19.0		

Table III. - Diet composition of 591 stomachs of *Pagellus erythrinus* containing food (%F = frequency of occurrence; %Cn = percentage numerical composition; %Cw = percentage gravimetric composition; IRI = Index of relative importance).

Food items	%F	%Cn	%Cw	IRI	%IRI
Mollusca					
Gastropoda					
Lunatia sp.	0.5	0.5	0.1	0.3	< 0.1
Gourmya sp.	0.5	0.5	0.2	0.3	< 0.1
Unidentified Gastropoda	0.3	0.6	0.4	0.3	< 0.1
Total Gastropoda	1.2	1.6	0.7	2.7	< 0.1
Bivalvia					
Cardium edule	3.2	4.3	3.5	24.9	0.8
Pitar rude	2.0	3.3	3.2	13.0	0.4
Chlamys sp.	1.7	3.0	3.1	10.3	0.3
Venerupis sp.	0.5	0.8	1.7	1.2	< 0.1
Telinella pulchella	0.3	0.6	1.1	0.5	< 0.1
Cardium sp.	0.3	0.3	0.7	0.3	< 0.1
Unidentified Bivalvia	3.5	5.0	4.6	33.6	1.0
Total Bivalvia	10.1	17.3	17.9	355.5	11.3
Cephalopoda					
Loligo vulgaris	0.5	0.5	0.9	0.7	< 0.1
Unidentified Cephalopoda	0.8	0.8	1.4	1.7	< 0.1
Total Cephalopoda	1.3	1.3	2.3	4.7	0.1
Polychaeta					
Aphrodita aculeata	3.5	4.6	3.7	29.0	0.9
Nephtys sp.	2.2	2.8	2.3	11.2	0.3
Unidentified Polychaeta	1.8	3.0	4.7	13.8	0.4
Total Polychaeta	5.6	10.4	10.7	118.1	3.7
Crustacea					
Decapoda					
Alpheus dentipes	6.7	8.7	6.5	101.8	3.2
Processa canaliculata	5.0	6.3	6.4	63.5	2.0
Alpheus sp.	4.2	5.0	4.8	41.1	1.3
Palaemon sp.	2.5	3.3	4.8	20.2	0.6
Alpheus glaber	2.3	3.0	3.7	15.4	0.5
Hypolite sp.	1.9	2.3	3.3	10.6	0.3
Upogebia sp.	1.7	2.1	3.0	8.6	0.2
Processa sp.	1.5	1.8	2.5	6.4	0.2
Processa edulis	0.5	0.5	1.0	0.7	< 0.1
Galathea strigosa	0.5	0.5	0.7	0.6	< 0.1
Liocarcinus corrugatus	0.8	1.0	2.1	2.5	< 0.1
Liocarcinus sp.	0.3	0.3	0.6	0.2	< 0.1
Munida sp.	0.3	0.3	0.6	0.2	< 0.1
Portunus sp.	0.5	0.5	0.9	0.7	< 0.1
Unidentified Decapoda	5.0	6.5	5.8	61.5	1.9
Total Decapoda	27.9	42.1	46.7	2477.5	79.3
Euphausiacea					
Nyctiphanes couchii	2.3	5.2	2.8	18.4	0.6
Euphausia krohni	3.0	3.3	2.2	16.5	0.5
Unidentified Euphausiacea	2.5	6.5	2.4	22.2	0.7
Total Euphausiacea	3.7	15.0	7.4	82.9	2.6

bivalves (%IRI = 11.3). Other prey groups found in the stomach contents showed lower IRI values and were thus considered of less importance. Due the advanced degree of digestion, identification to the species level was often impossible. Most common identifiable prey items were the shrimps *Alpheus dentipes* (%IRI = 3.2), *Processa canaliculata* (%IRI = 2.0), the polychaete *Aphrodite aculata* (%IRI = 0.9), and the bivalve *Cardium edule* (%IRI = 0.8) (Tab. III).

Food in relation to fish size

TL sample size ranged from 9.2 to 26.1 cm (Fig. 2). In order to evaluate variation in food habits as function of size, specimens from 13 to 21 cm were separated into 2 four-centimetre length classes. Due to small sample sizes of other fish lengths, the remaining specimens were separated into two length classes: < 13 cm (n = 162) and > 21 cm (n = 137). Sample size sufficient with respect to size classes and seasons were assessed by cumulative prey curves and *a priori* power analysis (Cohen, 1988; Ferry and Cailliet, 1996).

Decapods and bivalves were present in the diet of all length classes (Tab. II). Frequency of occurrence, numerical index, and IRI indicated that polychaetes were the most important prey group for the smallest length classes (< 13 cm TL) followed by decapods and euphausiids. Polychaetes and euphausiids IRI decreased with fish size, whereas that of decapods increased. Decapods markedly dominated in fish from 13 to 21 cm, while bivalves represented secondary important prey. In the stomach contents of largest individuals (> 21 cm TL), decapods represented the most important prey followed by teleosts. Cephalopods were represented only in largest size classes.

The mean weight of the stomach contents (Wm/ST) varied significantly among size classes (ANOVA, df = 3, F = 20.6, $p < 0.05$). Mean weight of the stomach contents for specimens larger than 21 cm, differed significantly from others (Fig. 3). The mean number of prey (Nm/ST) decreased with increasing size of fish. However, those changes were not significant (ANOVA, df = 3, F = 2.41, $p > 0.05$) (Fig. 3).

Schoener's overlap index (< 0.6) revealed quantitative differences in the diet between smaller specimens (< 13 cm TL) and individuals larger than 13 cm TL. High values of food overlap coefficient were observed between medium

Table III. - Continued.

Food items	%F	%Cn	%Cw	IRI	%IRI
Mysidacea					
Anhialina agilis	0.5	1.3	0.7	1.0	< 0.1
Unidentified Mysidacea	1.2	2.0	0.9	3.5	0.1
Total Mysidacea	1.3	3.3	1.6	6.3	0.2
Unidentified Isopoda	0.3	0.3	0.1	0.1	< 0.1
Unidentified Amphipoda	0.3	0.3	0.2	0.1	< 0.1
Echinodermata					
Unidentified Ophiuroidea	0.5	0.6	1.5	1.0	< 0.1
Teleostei					
Gobius sp.	2.3	2.6	2.4	11.5	0.3
Callionymus maculatus	1.5	1.8	1.6	5.1	0.1
Boop boops	0.5	0.5	1.3	0.9	< 0.1
Lepadogaster sp.	0.1	0.1	0.2	0.03	< 0.1
Unidentified Teleostei	1.2	1.3	4.2	6.6	0.2
Total Teleostei	4.7	6.3	9.7	75.2	2.4
Length range (TL)	9.1-26.1 cm				
Number of stomach examined	798				
Vacuity index	25.9				

length classes (13-17 and 17-21 cm TL). Diets of specimens in those size classes consisted mainly of decapods. Schoener's overlap index also revealed quantitative differences between larger specimens (> 21 cm) and other length classes (Tab. IV).

Seasonal variation in the diet composition

There was a low seasonal variation in feeding habits of *P. erythrnus* within the studied area. Decapods were the dominant prey group during all seasons, particularly in summer and autumn (Tab. I). Bivalves and teleosts were also present in the stomachs throughout the year, with a peak value recorded in winter. Polychaetes were also present in the stomachs throughout the year, but in smaller quantities.

The mean weight (Wm/ST) of prey items varied significantly throughout the year (ANOVA, df = 3, F = 17.1, $p < 0.05$) and was significantly greater (Tukey's test) in summer-autumn. The mean number (Nm/ST) of prey items also varied significantly throughout the year (ANOVA, df = 3, F = 13.3, $p < 0.05$) and was significantly greater (Tukey's test) in summer-autumn (Fig. 4).

Especially high values of food overlap coefficients were observed between summer and autumn (0.87). However, Schoener's index indicated high degree of diet overlap between all seasons (Tab. V).

Spatial differences in diet

Two main groups of sampling locations were determined by cluster analysis based on similarity of food. First group consists of two locations (A and D) that are closely similar to location E. Stations B and C form second group (Fig. 5). The MDS showed low stress (0.01) in two dimensions and the plot of the two dimensions gave the same picture as the dendogram (Fig. 6).

DISCUSSION

Present results indicated that *Pagellus erythrinus* populations inhabiting the eastern central Adriatic Sea are carnivorous. Decapods were the most abundant prey group, representing more than 50% of total IRI, and therefore they can be considered as the main food source for common pandora in this area (Rosecchi and Nouaze, 1987). Bivalves were secondary in importance while other prey groups were of less importance and indicate occasional food. Similarly to the results of the present study, Ardizzone and Messina (1983) and Caragitsou and Papaconstantinou (1988) report

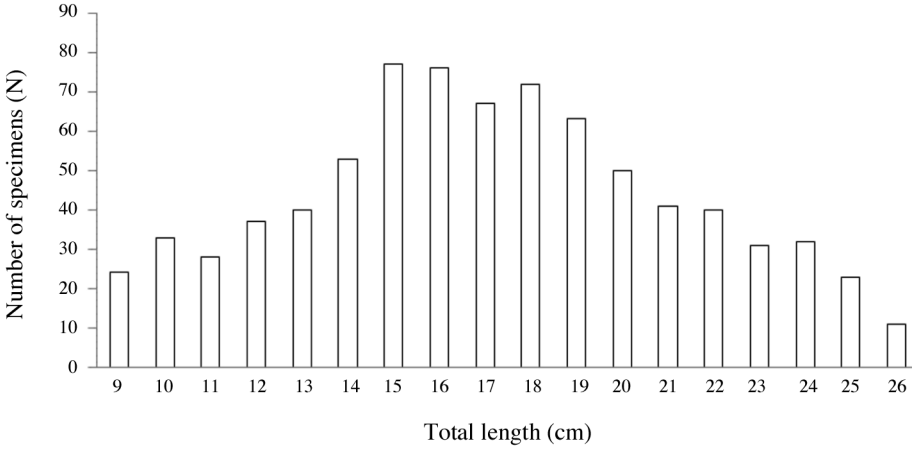

Figure 2. - Length-frequency distribution of *Pagellus erythrinus* specimens, caught in the eastern Adriatic Sea (n = 798).

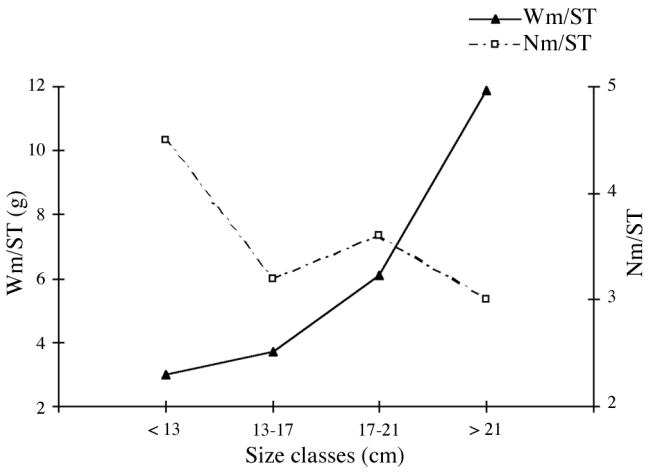

Figure 3. - Variation of the mean weight of prey per stomach (Wm/ST) and mean number of prey items per stomach (Nm/ST) of *Pagellus erythrinus* among size classes.

Table IV. - Proportional food overlap coefficients (Schoener's index) of the diet between size classes of *Pagellus erythrinus*.

Size class (cm)	< 13	13-17	17-21	> 21
< 13	-			
13 -17	0.31	-		
17 - 21	0.29	0.95	-	
> 21	0.21	0.47	0.49	-

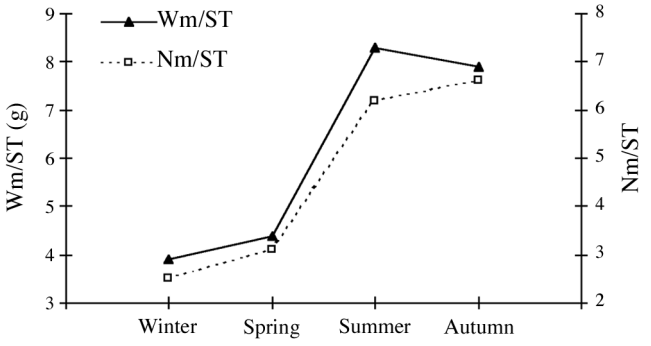

Figure 4. - Variation of the mean weight of prey per stomach (Wm/ST) and mean number of prey items per stomach (Nm/ST) of *Pagellus erythrinus* throughout the year.

Table V. - Seasonal proportional food overlap coefficients (Schoener's index) of the diet of *Pagellus erythrinus*.

Seasons	Winter	Spring	Summer	Autumn
Winter	-			
Spring	0.85	-		
Summer	0.66	0.71	-	
Autumn	0.73	0.80	0.87	-

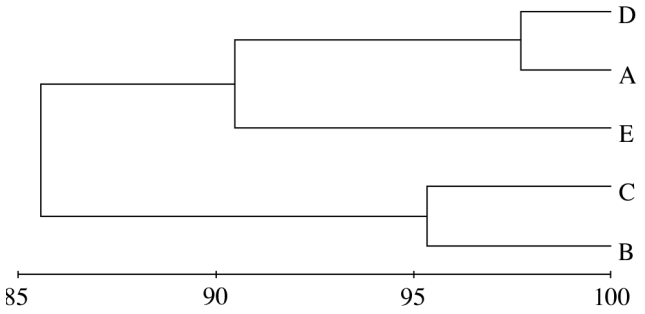

Figure 5. - UPGMA analysis using group-average linking of Bray-Curtis similarity on data of prey abundance between sampling locations (see Fig. 1).

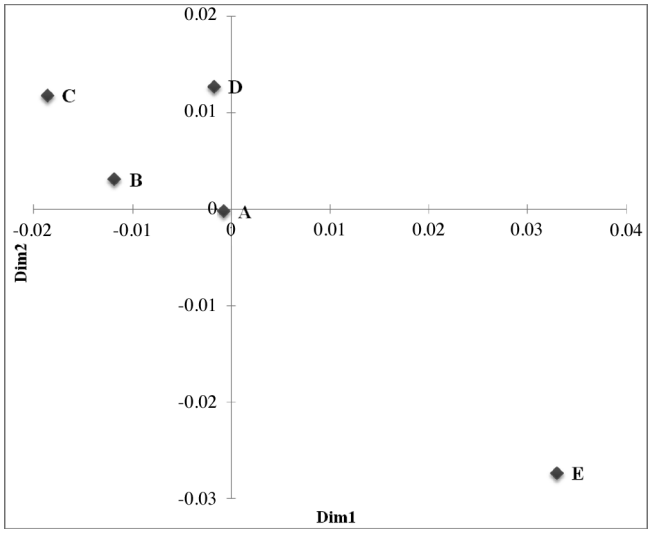

Figure 6. - Ordination diagram of MDS analysis between sampling locations (see Fig. 1).

that decapods dominated in the stomach contents of common pandora in the Tyrrhenian Sea and Patraikos Gulf (Greece), respectively. In the central Adriatic Sea (Kaštela Bay), decapods, polychaetes and bivalves constituted a main prey of this species (Jukić, 1972). Results of all these studies confirm the importance of decapods in the diet of common pandora. On contrary, Gurgel (1971) and Caragitsou and Papaconstantinou (1988) found that polychaetes dominated diet of *P. erythrinus* in the Gulf of Marseille and the Ionian Sea, respectively. Variation in the prey importance could be related to the presence/availability of different benthic assemblages among regions (Ferrari and Chieregato, 1981).

The pattern of stomach contents of common pandora in the present study agrees well with field distribution of several benthic species. For instance, in the eastern Adriatic Sea, decapods (*Alpheus* sp. and *Processa* sp.), bivalves (*Cardium edule*, *Telinella pulchella*) and polychaetes (*Aphrodite aculata*) are common on the sandy-muddy bottoms (Milišić, 2007, 2008). According to cluster analysis and MDS diagram, diet of common pandora indicated high similarity between sampling locations, respectively. Probably, this similarity could be due to resembling structure of benthic community at investigated areas. Namely, all sampling locations are placed on biocenosis of terrigenous muds (Jardas, 1996).

In present study, the stomach contents of the common pandora suggested that this species could be generalist predator, feeding on different prey items, including zooplanktonic organisms, benthic invertebrates and teleosts, and a wide range of prey sizes and morphologies. Food composition of common pandora collected from the central Adriatic by Jukić (1972) confirms presumption of its generalist behavior. Namely, in 259 fishes examined, prey items consisted 60 different prey species (decapods, bivalves, polychaets, teleosts, amphipods, zooplanktonic crustaceans, gastropods, cephalopods, scaphopods, ophiurids). However, in the Greek waters (Saronikos Gulf) the diet of common pandora was composed by 82 species of diverse benthic organisms (Caragitsou and Papaconstantinou, 1985). Diverse types of benthic prey species with wide range of size and morphologies were also noted by Larrañeta (1964) and Rosecchi (1983) in the western Mediterranean, and by Ardizzone and Messina (1983) in the Tyrrhenian Sea.

The food composition and dietary overlap reveal significant changes in the diet of common pandora with its growth. Smaller specimens mainly feed on polychaetes. As fish grows, the proportion of decapods increases in importance while the importance of polychaetes diminishes. This diet shift has been related to different niches occupied by the species through ontogeny, with larger individuals inhabiting deeper waters (Caragitsou and Papaconstantinou, 1988). Additionally, ontogenetic variation in the food resources could be related to the ability of larger specimens to grind hard parts of animals such as armours of decapods. The separation of feeding niches with size allows juveniles to coexist with adults (Langton, 1982). The ontogenetic shift in feeding habits is a general phenomenon among fish as result of increasing body size. Mean prey size increases with increasing predator size in order to optimise the energy input for growth (Stoner and Livingston, 1984). Moreover, trophic ontogeny of common pandora could be explained in terms of fish morphology. The width and gape of mouth are linearly related to the fish size (Stoner, 1980) and increased body and mouth size permit fish to capture a broader range of prey size and prey types.

Low seasonal variation in the diet of common pandora was noticed within study area. Values of Schoener's index (> 0.60) indicated high dietary overlap between seasons. Small variations of the abundance of the main prey items between seasons contributed to the high level on inter-seasonal proportional overlap. Decapods dominated the diet composition throughout the year, particularly in summer. Increased decapods consumption during summer coincides with the period of the new recruits of many decapods species, which may be present in high densities (Milišić, 2008). On the other hand, in the Egyptian Mediterranean waters, Rizzkala *et al*. (1999) observed considerable seasonal variation in the diet of common pandora. Polychaetes were dominant prey in winter and spring, while crustacean were more frequent in other seasons. These differences may be related to seasonal variation in food availability at different areas.

Feeding intensity is negatively related to the percentage of empty stomachs (Bowman and Bowman, 1980). In our study, the significantly highest values of stomach emptiness were recorded during the winter and spring. Similarly, Jukić and Županović (1965) noted lower feeding intensity of common pandora throughout winter-spring seasons. Poorer feeding intensity in winter is correlated to minimum seawater temperatures in study area, which slow down the metabolism, and thereby further results in reduced feeding (Jukić and Županović, 1965). In our study, this statement was confirmed by the values of mean weight (Wm/ST) and mean number (Nm/ST), which were significantly highest in summer-autumn, and were decreasing in winter-springs periods. Also, spawning period, which mainly takes place in spring have an effect on lower feeding intensity (Jukić and Županović, 1965). Feeding behavior of most fish species considerably oscillates during the year as a consequence of physiological changes during reproduction. Intensified feeding extends throughout the summer probably to higher temperatures and prey availability. In Adriatic waters many groups of benthic organisms are present in higher abundance and density during warmer part of year (Baranović *et al*., 1992).

In conclusion, *Pagellus erythrinus* could be a trophic generalist, whose diet in the Adriatic Sea as well as in the Mediterranean areas consists of diverse benthic groups, with wide range of size and morphology. In the eastern central Adriatic Sea decapodes were the most important prey in all seasons as well as in large specimens, whereas polychaetes constituted the main prey in stomach of smaller individuals.

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Reçu le 9 février 2011.
Accepté pour publication le 3 mai 2011.